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Micromechanics of dynamic solid-to-solid phase transformations

Bronkhorst, Curt, cabronk@lanl.gov, Los Alamos National Laboratory

ABSTRACT

The macromechanical response of polycrystal metallic materials has its basis in the microstructure of the material; many dynamic deformation processes are dictated by mechanisms at the subgrain scale. Therefore, in an effort to develop physically based, predictive macromechanical models, work is being conducted on the single and poly-crystal behavior of materials. The micromechanical scale also offers a bridge between the atomistic and macromechanical scales. Theoretical extensions to micromechanical models include the coupled effects of phase transformations, plasticity (slip and twinning), damage, and nonlinear elasticity. These theoretical and computational tools allow investigations into microstructural aspects of high-rate and high-pressure deformation and transformation processes. The influence of material heterogeneity on retained high-pressure phases, damage, and texture evolution will be facilitated by this capability. The modeling, computation, and experimental study of the micromechanics of solid–solid phase transformation in Zr/Ti will be discussed in this presentation.